TITLE OF THE INVENTION
ELASTIC SLEEVE FOR SHOE PRESS, METHOD OF MANUFACTURING THE ELASTIC SLEEVE FOR SHOE PRESS AND SHOE PRESS ROLL

TECHNICAL FIELD

The present invention relates to a shoe press roll which presses a web material with a long nip width, and more particularly, to an elastic sleeve for a shoe press formed of an elastic material in the shape of a tube, a manufacturing method thereof and a shoe press roll employing the same.

BACKGROUND ART

A shoe press is used in a dehydrating press process in the paper manufacturing industry. To put it briefly, the shoe press forms a pressing region with a large width by pressing an elastic belt (sleeve) toward an opposed press roll by using a press shoe having a predetermined width in the running direction and performs a pressing (dehydrating) process for a web material (wet paper web) which is an object to be pressed in this pressing region. Although a normal roll press applies linear pressure to the object to be pressed, according to the shoe press, since the press shoe has the predetermined width in the running direction, area pressure can be applied to the pressed object. Thus, when the shoe press is used, there are merits in which a nip width can be increased and process performance can be improved.

In addition, other than the dehydrating press, it is considered that the shoe press is used for a calender in which a web material such as paper, a magnetic tape and the like is glazed in the paper manufacturing industry, the magnetic recording medium manufacturing industry and the like.

Japanese Patent Publication No. 2-53543 discloses a press roll which forms a press nip in cooperation with a counter roll, and Japanese Unexamined Patent Publication No. 2000-178892 discloses a method and an apparatus for calendering a fiber web using a surrounded shoe roll.

Fig. 3 is a sectional view showing a shoe press apparatus 100 taken along the direction perpendicular to an axis line, and Fig. 4 is a sectional view showing the shoe press apparatus taken along the axis line. Referring to Figs. 3 and 4, the shoe press apparatus 100 comprises a press

roll 101, and a shoe press roll 102 which is opposed to the press roll 101.

The press roll 101 is formed of a hard material such as metal, stone, synthesized stone, ceramic and the like and it is rotated at high speed. The shoe press roll 102 comprises a support shaft 103 which is not rotated substantially, a press shoe 104 set on the support shaft 103, a sleeve support member 105 mounted on each end of the support shaft 103, and an elastic sleeve 106 which covers the support shaft 103 and the press shoe 104 and has an end supported by the sleeve support member 105. The elastic sleeve 106 is mounted such that it is pulled in from one end of the shoe press roll 102 so as to cover the outer peripheral surface of the sleeve support member 105. The sleeve support member 105 is in the shape of a disk, which constitutes an end face of the shoe press roll 102.

A bearing is interposed between an inner diameter of the sleeve support member 105 and the support shaft 103, and the sleeve support member 105 can be rotated around the support shaft 103. The press shoe 104 applies pressure to the elastic sleeve 106 from the inside to the outside by pressing means such as pneumatic means, hydraulic means and the like. Lubrication oil is supplied between the press shoe 104 and an inner face of the elastic sleeve 106, and the elastic sleeve 106 is rotated around the support shaft 103 together with the sleeve support member 105, sliding on the press shoe 104. The elastic sleeve 106 is formed of a synthetic resin material which is not permeable to gas and liquid. Such material is polyurethane, for example.

The elastic sleeve 106 and the sleeve support member 105 are surely sealed and fixed so as not to leak the lubrication oil outside, and to maintain air tightness in the shoe press roll. The shoe press roll 102 is operated in a state the elastic sleeve 106 is swollen. A web material 107 such as a wet paper web which is an object to be pressed is passed between the elastic sleeve 106 and the press roll 101. The surface of the press shoe 104 has a predetermined width in the running direction and it is gently curved so as to correspond to the surface of the press roll 101. Therefore, a wide pressing region is formed between the press roll 101 and the shoe press roll 102, and the web material 107 is pressed in this pressing region.

Since complex force such as compressive force, tensile force and the like is applied to the elastic sleeve 106 on the shoe press roll 102 during the

operation, the elastic sleeve 106 has been conventionally formed of a composite material comprising an elastic material and a reinforcing material such as a base cloth in order to maintain its strength and dimension against the force applied during the operation.

However, the elastic sleeve 106 is extended because of fatigue and it is gradually swollen in the diameter direction because of pressure from the inside also. When the elastic sleeve 106 is swollen in the diameter direction, the elastic sleeve 106 flaps during the operation and the rotation becomes unstable. As a result, the web material is damaged or its quality deteriorates, and a scratch, abrasion or crack is generated in the elastic sleeve 106.

DISCLOSURE OF INVENTION

Thus, it is an object of the present invention to provide an elastic sleeve for a shoe press which is prevented from being swollen, to improve durability and maintain running stability for a long period, its manufacturing method and a shoe press roll using it.

According to an elastic sleeve for a shoe press in the present invention, it is formed of an elastic material into the shape of a tube to be used as an outer cylinder of a shoe press roll which presses a web material with a long nip width and characterized in that an inner diameter is gradually reduced from both ends to a center in an axial direction.

In addition, a shoe press roll in the present invention comprises a support shaft which is not rotated substantially, a press shoe set on the support shaft, a sleeve support member which is mounted on each end of the support shaft and can be rotated around the support shaft, and an elastic sleeve which covers the support shaft and the press shoe and has an end supported by the sleeve support member, in which the press shoe presses the elastic sleeve from the inside to the outside, and the elastic sleeve slides on the press shoe and rotates around the support shaft with the sleeve support member, and it is characterized in that the elastic sleeve has an inner diameter gradually reduced from both ends to a center in an axial direction.

As described above, since the inner diameter of the elastic sleeve is gradually reduced from the both ends to the center in the axial direction,

the elastic sleeve can be prevented from being swollen by use.

Furthermore, a method of manufacturing an elastic sleeve for a shoe press in the present invention comprises a step of stretching a sleeve formed of an uncured or imperfectly cured elastic material between two rolls, a step of moving the two rolls in directions apart from each other, a step of deflecting the two rolls in such directions that center parts thereof are moved close to each other by utilizing tension of the sleeve, and a step of perfectly curing the elastic material while rotating the sleeve in this state.

According to the above method, the elastic sleeve for the shoe press in which the inner diameter is gradually reduced from the both ends to the center in the axial direction can be easily manufactured.

More preferably, a difference in inner diameter between the both ends and the center of the elastic sleeve is 1mm to 15mm. When the difference in inner diameter is selected from the above range, the elastic sleeve is not swollen by relatively short-time use and the elastic sleeve can be easily mounted. More preferably, a lower limit value of the difference is 5mm, and an upper limit value thereof is 10mm.

Still further, the elastic sleeve comprises an elastic material and a reinforcing material, and the reinforcing material is a base cloth. Thus, even when the complex force such as the compression force and the tensile force is applied to the elastic sleeve from the multiple directions, it can resist against the force.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a sectional view showing an elastic sleeve for a shoe press according to the present invention.

Fig. 2 is a conceptual view showing a method of manufacturing the elastic sleeve according to the present invention.

Fig. 3 is a conceptual view showing a shoe press apparatus.

Fig. 4 is a sectional view showing the shoe press apparatus.

BEST MODE FOR CARRYING OUT THE INVENTION

Fig. 1 is a sectional view showing an elastic sleeve 1 for a shoe press according to the present invention. The elastic sleeve 1 is made of an elastic material and formed into an endless tube. As shown in Fig. 1, the

elastic sleeve 1 has an inner diameter gradually reduced from both ends toward a center in an axial direction. It is preferable that a difference in inner diameter between both ends and the center is within a range of 1mm to 15mm. More preferably, its lower limit value is 5mm and its upper limit value is 10mm. When the difference in inner diameter between both ends and the center is less than 1mm, the elastic sleeve is swollen by relatively short-time use, which is not recommended.

A shoe press roll 102 has a structure in general as shown in Figs. 3 and 4. When the shoe press roll 102 is assembled, the elastic sleeve 1 is mounted such that it is pulled in from one end of the she press roll 102 so as to cover a sleeve support member 105.

At this time, when the difference in inner diameter between the center and the both ends is more than 15mm, an inner peripheral surface of the elastic sleeve 1 gets caught in the sleeve support member 105 while it is mounted, which is not recommended.

In order to maintain its strength and dimension, it is preferable that the elastic sleeve 1 is formed of a material containing an elastic material and a reinforcing material and they are integrated. As the reinforcing material, a base cloth or a reinforcing thread is used. Since complex force such as compressive force, tensile force and the like is applied to the elastic sleeve 1 from multiple directions during an operation, the base cloth is preferably used in order to resist against the force from the multiple directions. More specifically, it is preferable that an inner peripheral surface or both inner and outer peripheral surfaces of the reinforcing base material comprising an endless multiply-woven cloth is coated with the elastic material. The elastic material is molded with a thermosetting resin in general. As such elastic material, although polyurethane is used in general, another elastic material may be used.

Next, a preferred method of manufacturing the elastic sleeve 1 will be described with reference to Fig. 2. First, the elastic sleeve 1 is formed of an uncured or imperfectly cured elastic material by coating an inner peripheral surface or both inner and outer peripheral surface of the tube-shaped base cloth comprising the multiply-woven cloth with a liquid elastic material. Then, the elastic sleeve 1 formed of the uncured or imperfectly cured elastic material is stretched between two rolls 2 and 3. Then, as shown in Fig. 2,

the two rolls 2 and 3 are moved in directions apart from each other and they are deflected in such directions that the center parts thereof are moved close to each other by utilizing tension of the elastic sleeve 1. In this state, the elastic material is heated up to be perfectly cured while the elastic sleeve 1 is rotated. Thus, the elastic sleeve for the shoe press in which the inner diameter is reduced gradually from both ends toward the center in the axial direction is manufactured.

In this method, it is preferable that the strength when the two rolls 2 and 3 are moved in directions apart from each other is adjusted such that a deflection degree of the two rolls may be 1mm to 15mm. In such adjustment the elastic sleeve 1 in which the difference in inner diameter between both ends and the center is 1mm to 15mm can be manufactured. More preferably, a lower limit value of the deflection degree of the roll is 5mm and an upper limit value thereof is 10mm.

A structure of the shoe press roll 102 according to the present invention is the same as a conventional structure, and the description made with reference to Figs. 3 and 4 can be applied as it is. However, instead of the conventional elastic sleeve 106, the elastic sleeve 1 according to the present invention is used as an outer cylinder of the shoe press roll 102.

As described above, according to the elastic sleeve for the shoe press in the present invention and the shoe press roll employing the same, since the inner diameter of the elastic sleeve is gradually reduced from both ends to the center in the axial direction, the elastic sleeve can be prevented from being swollen by use. As a result, running stability can be maintained for a long period and durability can be improved.

According to the method of manufacturing the elastic sleeve for the shoe press in the present invention, the sleeve formed of the uncured or imperfectly cured elastic material is stretched between two rolls 2 and 3, the two rolls 2 and 3 are moved in directions apart from each other and deflected in such directions that the center parts thereof are moved close to each other by utilizing tension of the sleeve, and in this state the elastic material is heated up to be perfectly cured while the sleeve is rotated. As a result, the elastic sleeve for the shoe press in which the inner diameter is reduced gradually from both ends toward the center in the axial direction is manufactured.

Although one embodiment of the present invention has been described with reference to the drawings, the present invention is not limited to the illustrated embodiment. It is needless to say that various kinds of variation can be added to the illustrated embodiment within the same or the equivalent scope of the present invention.

INDUSTRIAL APPLICABILITY

The present invention can be advantageously applied to an elastic sleeve for a shoe press and a shoe press roll which are used in a dehydrating press process in the paper manufacturing industry.

CLAIMS

1. An elastic sleeve for a shoe press formed of an elastic material into the shape of a tube to be used as an outer cylinder of a shoe press roll which presses a web material with a long nip width, characterized in that

an inner diameter is gradually reduced from both ends to a center in an axial direction.

2. The elastic sleeve for the shoe press according to claim 1, wherein a difference in inner diameter between both ends and the center is 1mm to 15mm.

3. The elastic sleeve for the shoe press according to claim 2, wherein the difference in inner diameter between both ends and the center is 5mm to 10mm.

4. The elastic sleeve for the shoe press according to claim 1, wherein said elastic sleeve comprises an elastic material and a reinforcing material.

5. The elastic sleeve for the shoe press according to claim 4, wherein said reinforcing material is a base cloth.

6. A method of manufacturing an elastic sleeve for a shoe press comprising:

a step of stretching a sleeve formed of an uncured or imperfectly cured elastic material between two rolls;

a step of moving said two rolls in directions apart from each other;

a step of deflecting said two rolls in such directions that center parts thereof are moved close to each other by utilizing tension of said sleeve; and

a step of perfectly curing said elastic material while rotating said sleeve in this state.

7. The method of manufacturing the elastic sleeve for the shoe press according to claim 6, wherein a deflection degree of said roll is 1mm to 15mm.

8. The method of manufacturing the elastic sleeve for the shoe press according to claim 6, wherein said elastic sleeve comprises an elastic material and a reinforcing material.

9. The method of manufacturing the elastic sleeve for the shoe press according to claim 8, wherein said reinforcing material is a base cloth.

10. A shoe press roll comprising:

a support shaft which is not rotated substantially;

a press shoe set on said support shaft;

a sleeve support member which is mounted on each end of said support shaft and can be rotated around said support shaft; and

an elastic sleeve which covers said support shaft and said press shoe and has an end supported by said sleeve support member,

said press shoe pressing said elastic sleeve from the inside to the outside, and said elastic sleeve sliding on said press shoe and rotating around said support shaft with said sleeve support member, characterized in that

said elastic sleeve has an inner diameter gradually reduced from both ends to a center in an axial direction.

11. The shoe press roll according to claim 10, wherein a difference in inner diameter between both ends and the center of the elastic sleeve is 1mm to 15mm.

12. The shoe press roll according to claim 10, wherein said elastic sleeve comprises an elastic material and a reinforcing material.

13. The shoe press roll according to claim 12, wherein said reinforcing material is a base cloth.

ABSTRACT

A method of manufacturing an elastic sleeve for a shoe press having an inner diameter gradually reduced from both ends toward a center in an axial direction, comprising the steps of stretching the sleeve formed of an uncured or imperfectly cured elastic material between two rolls, moving the two rolls in directions apart from each other while deflecting the two rolls in such directions that the center parts thereof are moved close to each other by utilizing the tension of the sleeve, and perfectly curing, in this state, the elastic material while rotating the sleeve to gradually reduce the inner diameter of the elastic sleeve from both ends toward the center in the axial direction.

FIG. 1

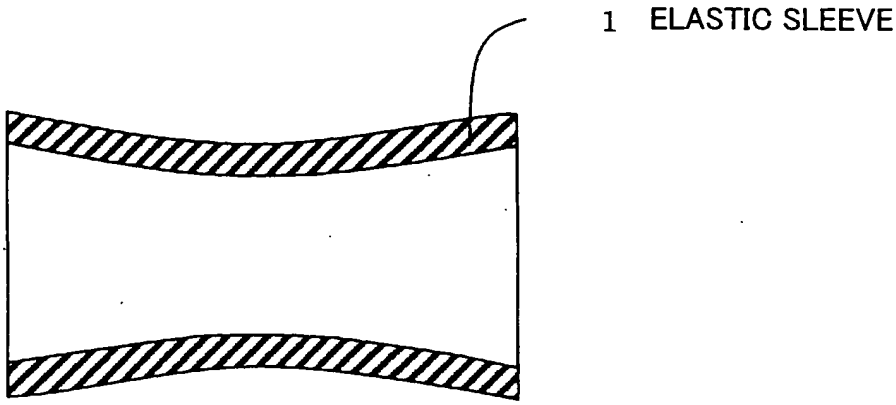


FIG. 2

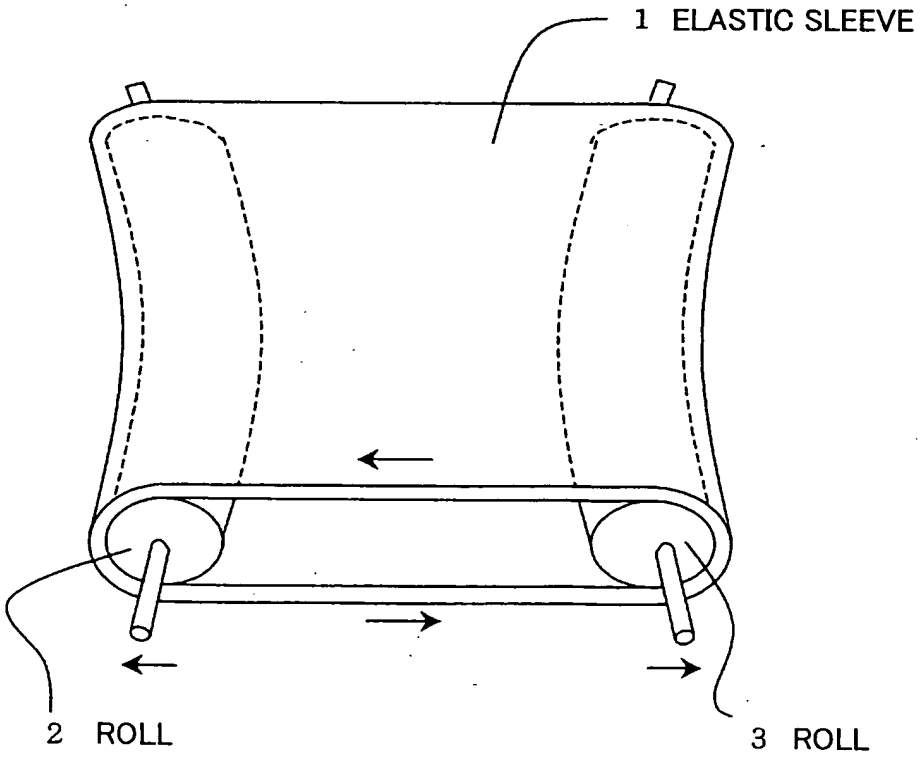


FIG. 3

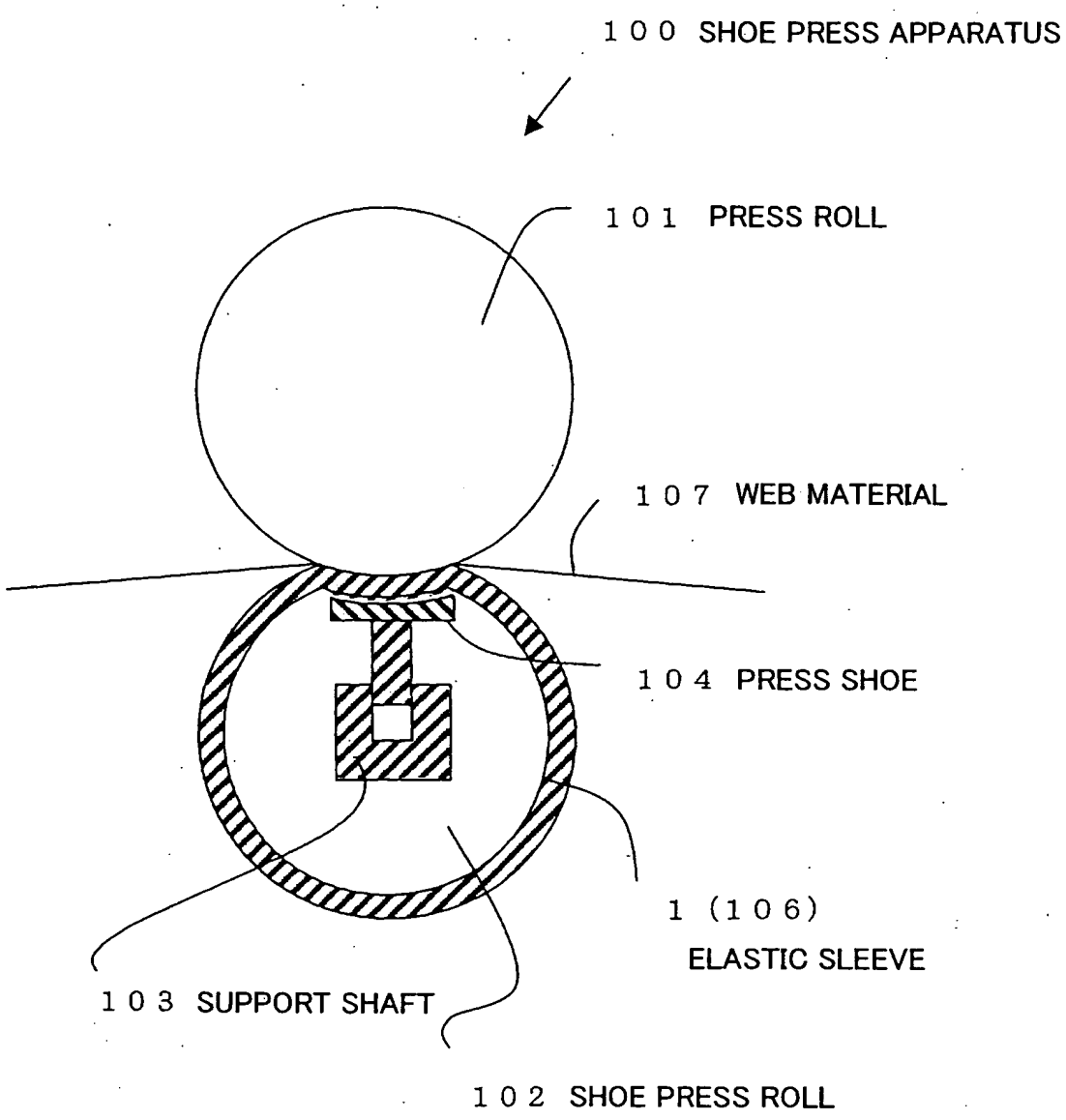
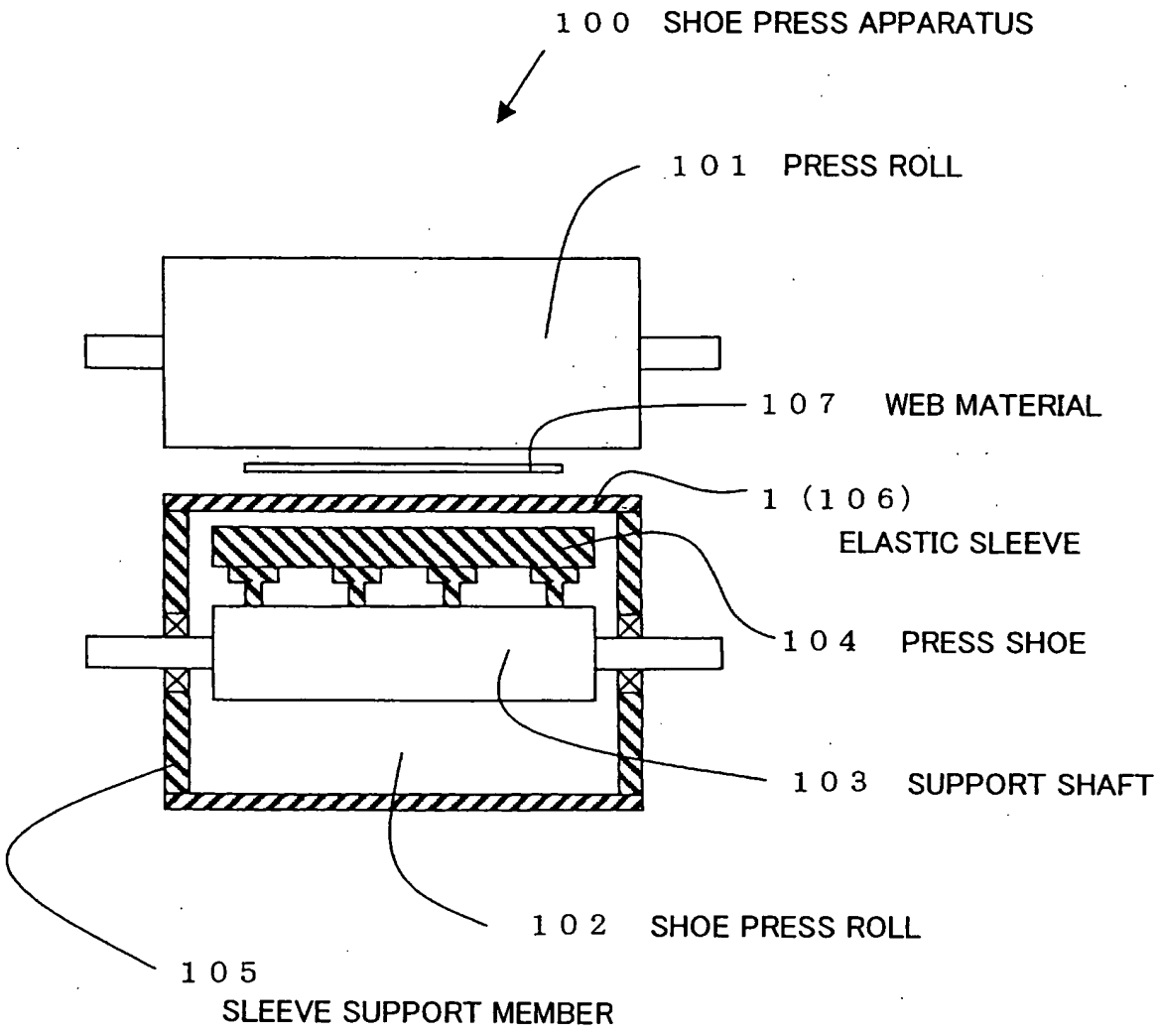

100 SHOE PRESS APPARATUS
101 PRESS ROLL
107 WEB MATERIAL
104 PRESS SHOE
1 (106)
ELASTIC SLEEVE
103 SUPPORT SHAFT
102 SHOE PRESS ROLL

FIG. 4


100 SHOE PRESS APPARATUS
101 PRESS ROLL
107 WEB MATERIAL
1 (106)
ELASTIC SLEEVE
104 PRESS SHOE
103 SUPPORT SHAFT
102 SHOE PRESS ROLL
105
SLEEVE SUPPORT MEMBER